Math Test – No Calculator

25 MINUTES, 20 QUESTIONS

Turn to Section 3 of your answer sheet to answer the questions in this section.

DIRECTIONS

For questions 1–15, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 16–20**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 16 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

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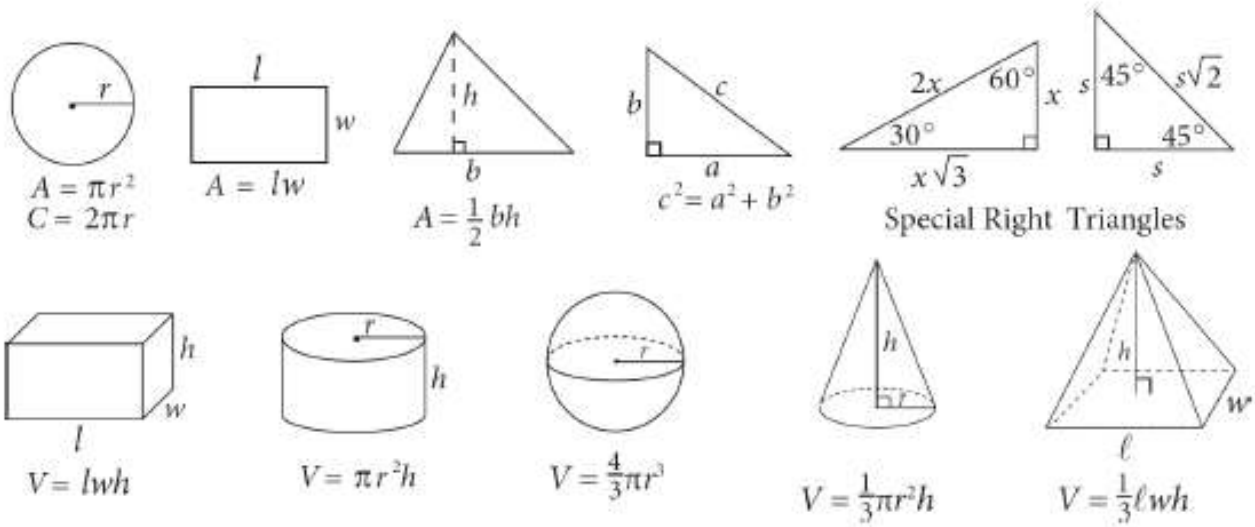
3. Figures provided in this test are drawn to scale unless otherwise indicated.
4. All figures lie in a plane unless otherwise indicated.
5. Unless otherwise indicated, the domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

REFERENCE



The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π.

The sum of the measures in degrees of the angles of a triangle is 180.

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1. Which of the following is equivalent to $10 + 2(x - 7)$?

A) $-14x + 10$

B) $2x + 24$

C) $2x + 3$

D) $2x - 4$

2.

$$3x - \frac{y}{3} = 21$$

$$x = y + 7$$

Which ordered pair (x, y) satisfies the system of equations shown above?

A) $(0, -7)$

B) $(4, 27)$

C) $(7, 0)$

D) $(9, -16)$

3.

$$a + b = 15$$

The equation above relates the number of hours, a, Kevin spends doing homework each week and the number of hours he spends watching television each week. If Kevin spends a total of 15 hours doing homework and watching television each week, what does the variable b represent?

A) The number of hours spent watching television for each hour spent doing homework

B) The number of hours spent watching television each week

C) The number of hours spent doing homework each week

D) The total number of hours spent doing homework and watching television each week

4. Josephine purchases a computer for $4,590. The computer decreases in value at a constant rate for 9 years, after which it is considered not to have any monetary value. How much is the computer worth 6 years after it is purchased?

A) $1,530

B) $2,295

C) $3,060

D) $4,080

5. For $i = \sqrt{-1}$, which of the following complex numbers is equivalent to $(10i - 4i^2) - (7 - 3i)$?

A) $-11 + 7i$

B) $-3 + 13i$

C) $3 - 13i$

D) $11 - 7i$

6. What is the value of $f(-2)$ if $f(x) = \dfrac{x^2 + 4x - 8}{x - 2}$?

A) −3

B) −1

C) 1

D) 3

7. Heinrich must buy at least 100 shares of stock for his portfolio. The shares he buys will be from Stock X, which costs $22 per share and Stock Y, which costs $35 per share. His budget for buying stock is no more than $4,500. He must buy at least 20 shares of Stock X and 15 shares of Stock Y. Which of the following represents the situation described if a is the number of shares of Stock X purchased and b is the number of shares of Stock Y purchased?

A) $22a + 35b \leq 4{,}500$
$a + b \geq 100$
$a \leq 20$
$b \leq 15$

B) $22a + 35b \leq 4{,}500$
$a + b \leq 100$
$a \leq 20$
$b \leq 15$

C) $22a + 35b \leq 4{,}500$
$a + b \leq 100$
$a \geq 20$
$b \geq 15$

D) $22a + 35b \leq 4{,}500$
$a + b \geq 100$
$a \geq 20$
$b \geq 15$

8.

$$x^2 - 8x + 5$$

Which of the following is equivalent to the expression above?

A) $(x-4)^2-11$

B) $(x-4)^2+11$

C) $(x+4)^2-11$

D) $(x+4)^2+11$

9. Juliet is selling photographs as part of a project for her entrepreneurship class. She sells the first 20 photographs for $10 each. Because the first 20 photographs sold so quickly, she raised the price of the photographs to $15 each for the rest of the project. After her expenses, Juliet earns a profit of 80% of the revenues from her sales. What is the least number of photographs she must sell for the rest of the project to earn a profit of at least $400 ?

A) 18

B) 20

C) 24

D) 32

10.

$$\frac{p^{\frac{1}{4}}q^{-3}}{p^{-2}q^{\frac{1}{2}}}$$

Which of the following is equivalent to the expression above, where $p > 1$ and $q > 1$?

A) $\frac{p^2\sqrt[4]{p}}{q^3\sqrt{q}}$

B) $\frac{p^2\sqrt{p}}{q^3\sqrt{q}}$

C) $\frac{\sqrt[4]{p}}{q^3\sqrt{q}}$

D) $\frac{\sqrt[4]{p}}{\sqrt[3]{q^2}}$

11. The graph of function g in the xy-plane is a parabola defined by $g(x) = (x - 2)(x - 4)$. Which of the following intervals contains the x-coordinate of the vertex of the graph?

A) $6 < x < 8$

B) $4 < x < 6$

C) $-2 < x < 4$

D) $-4 < x < -2$

12.

$$xa^3 + ya^2 + za = 0$$

In the equation above, x, y, and z are constants. If the equation has roots -6, 0, and 4, which of the following is a factor of $xa^3 + ya^2 + za$?

A) $a - 2$

B) $a + 4$

C) $a - 6$

D) $a + 6$

13. If the expression $\frac{1}{2}(x + c)(x - c)$, where c is a positive constant, can be rewritten as $\frac{1}{2}x^2 - 5$, what is the value of c ?

A) $\sqrt{5}$

B) $\sqrt{10}$

C) 5

D) 10

14. Which of the following is equivalent to $\frac{z^2 + 7z - 3}{z + 2}$?

A) $z + 5 - \frac{13}{z + 2}$

B) $z + 5 - \frac{7}{z + 2}$

C) $z + 9 - \frac{21}{z - 2}$

D) $z + 9 - \frac{15}{z - 2}$

15. A homeowners' association limits the dimensions of the pools that it will allow in a particular subdivision. The bylaws state that permits will only be granted for pools shaped like rectangular prisms, for which the sum of the length of the pool and the perimeter of the vertical side containing the ladder cannot exceed 200 meters. The perimeter of the ladder side is determined using the width and the depth of the pool. If a pool has a length of 75 meters and its width is 1.5 times its depth, which of the following shows the allowable depth a, in meters, of the pool?

A) $0 < a \leq 62\frac{1}{2}$

B) $0 < a \leq 50$

C) $0 < a \leq 31\frac{1}{4}$

D) $0 < a \leq 25$

DIRECTIONS

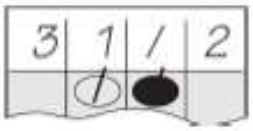
For questions 16–20, solve the problem and enter your answer in the grid, as described below, on the answer sheet.

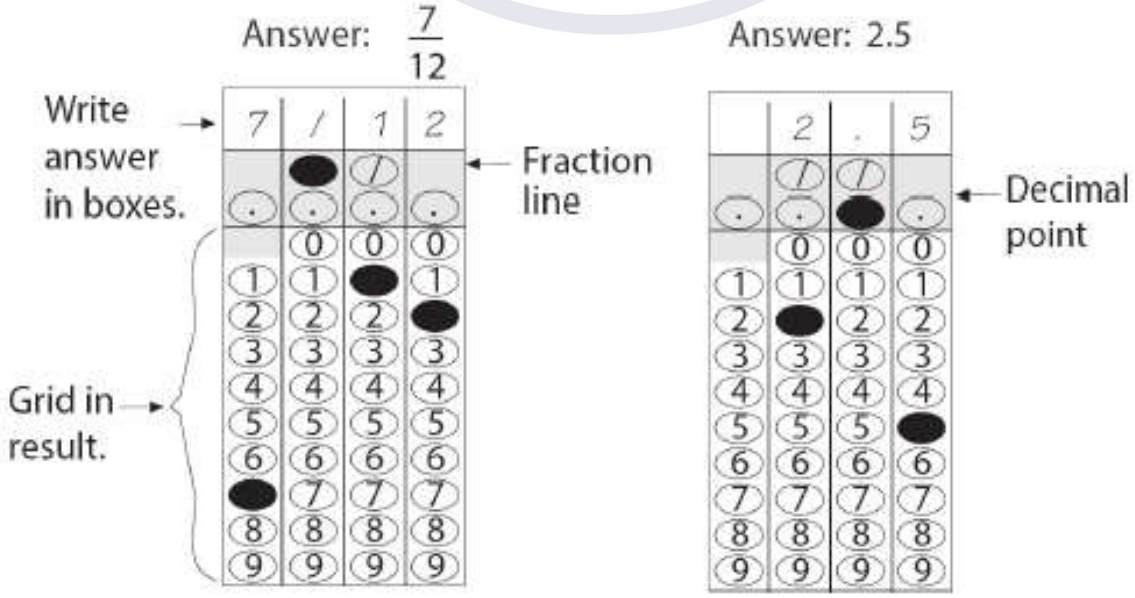
1. Although not required, it is suggested that you write your answer in the boxes at the top of the columns to help you fill in the circles accurately. You will receive credit only if the circles are filled in correctly.

2. Mark no more than one circle in any column.

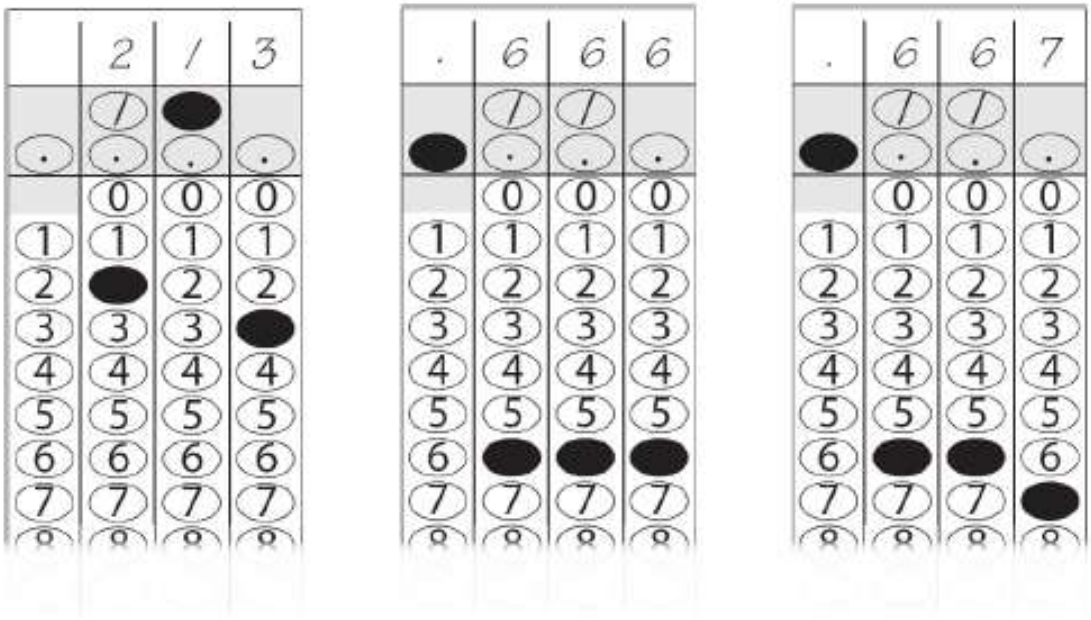
3. No question has a negative answer.

4. Some problems may have more than one correct answer. In such cases, grid only one answer.

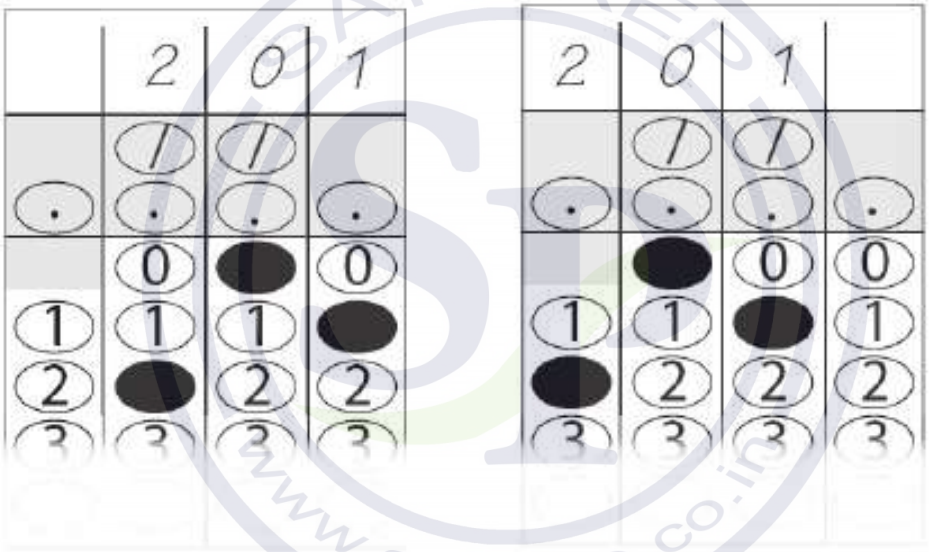
5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If  is entered into the grid, it will be interpreted as $\frac{31}{2}$, not as $3\frac{1}{2}$.) 6. **Decimal Answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.



Acceptable ways to grid $\frac{2}{3}$ are:

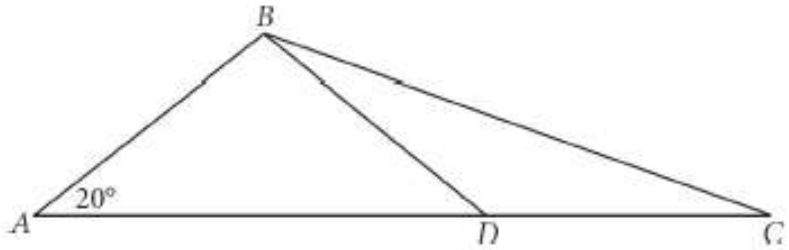


Answer: 201 – either position is correct



NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

16.



In the figure above, point D is on line AC, $AB = BD = CD$, and $AD = 15$. What is the measure, in degrees, of $\angle BCD$? (Disregard the degree symbol when gridding your answer.) **17.** If $15 - 3b = 21$, what is the value of $5 -$

b ?

18. The graph of a line in the xy-plane passes through the point $(-2, k)$ and crosses the x-axis at the point $(-4, 0)$. The line crosses the y-axis at the point $(0, 12)$. What is the value of k ?

19.

$$5(10x^2 - 300) + (9844 + 50x^2)$$

The expression above can be rewritten in the form $cx^2 + d$, where c and d are constants. What is the value of $d - c$?

20. If n is a constant equal to the number of degrees in an angle measuring 3π radians, what is the value of n ?

STOP

If you finish before time is called, you may check your work on this section only. Do not turn to any other section in the test.

Math Test – Calculator

55 MINUTES, 38 QUESTIONS

Turn to Section 4 of your answer sheet to answer the questions in this section.

DIRECTIONS

For questions 1–30, solve each problem, choose the best answer from the choices provided, and fill in the corresponding circle on your answer sheet. **For questions 31–38**, solve the problem and enter your answer in the grid on the answer sheet. Please refer to the directions before question 31 on how to enter your answers in the grid. You may use any available space in your test booklet for scratch work.

NOTES

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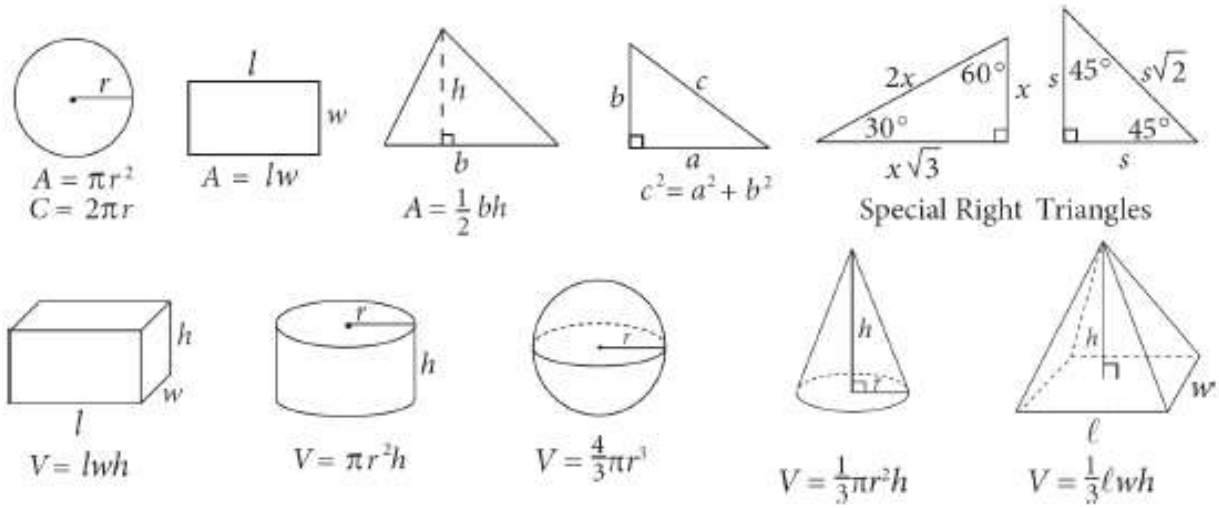

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π.

The sum of the measures in degrees of the angles of a triangle is 180.

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1. A certain homeowner uses a gas edger to clean up his lawn every time he mows. If the edger uses 160 milliliters of fuel each time, what is the maximum number of times the homeowner can edge his lawn with 8 liters of fuel? (1 liter = 1,000 milliliters)

A) 5

B) 50

C) 100

D) 1,000

2.

Assignment Choice for Two Physics Classes

	Dr. Soper	Mr. Coelho	Total
Lab Report Only	17	21	38
Lab Report and Final Exam	3	2	5
Total	20	23	43

The table above shows the number of students who chose to be graded on lab reports only or on lab reports and final exams in Dr. Soper's and Mr. Coelho's physics classes. What fraction of the students in Dr. Soper's class

Coelho's physics classes. What fraction of the students in Dr. Soper's class chose to be graded on the lab report and final exam?

A) $\frac{3}{43}$

B) $\frac{5}{43}$

C) $\frac{3}{20}$

D) $\frac{3}{5}$

3.

$$(4 - a^2) - (2a^2 - 6)$$

Which of the following expressions is equivalent to the one above?

A) $a^2 - 2$

B) $a^2 + 10$

C) $-3a^2 - 2$

D) $-3a^2 + 10$

4. The ordered pair $(3, -1)$ satisfies which of the following inequalities?

I. $x + 3y > 0$

II. $2x + 3y > 2$

III. $x + y < 0$

A) I only

B) II only

C) I and III only

D) II and III only

5. A psychology student randomly selected 300 people from a group of people who indicated that they preferred to work alone. Those 300 people were given a task to work on individually and then asked whether they were happy or unhappy while doing the task. Of those surveyed, 5% stated they were unhappy while doing the task. Which of the following inferences can appropriately be drawn from this survey result?

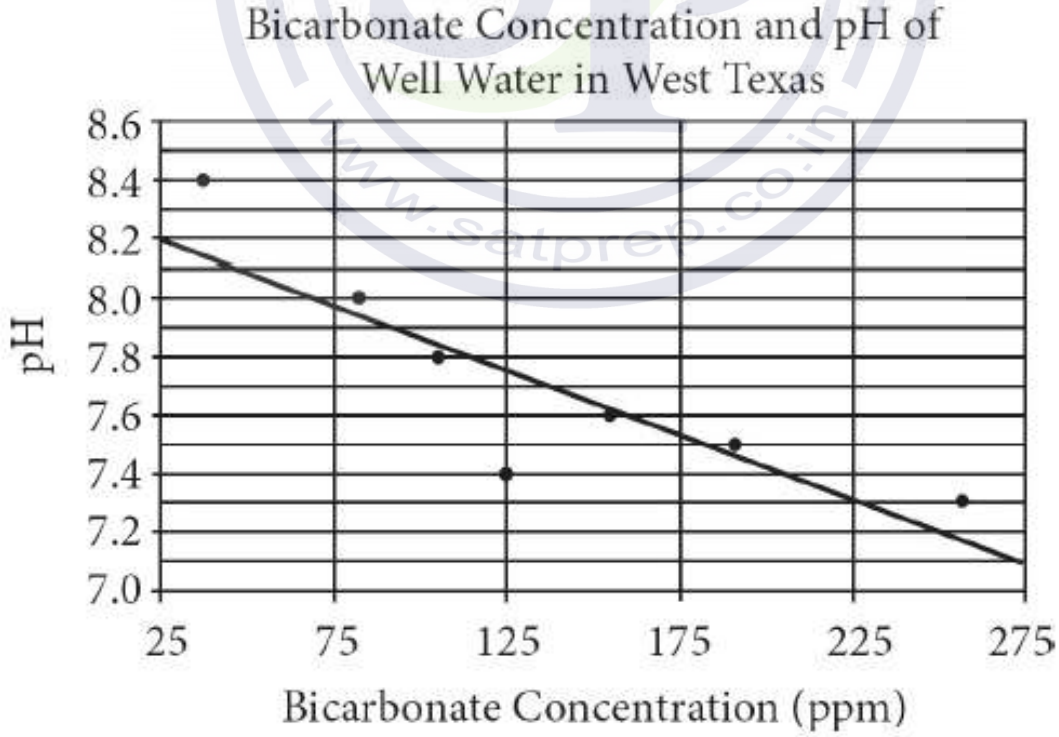
A) Few people who prefer working alone will be unhappy doing this task.

B) Few people who do not prefer working alone will be happy doing this task.

C) Less than 5% of people will be happy doing this task if they do not work alone.

D) Less than 5% of people will be unhappy doing this task if they work alone.

Questions 6 and 7 refer to the following information.



The scatterplot above shows the pH of seven well water samples in West Texas with respect to the bicarbonate concentration in ppm (parts per million). The line of best fit is also shown.

6. According to the scatterplot, which of the following statements about the relationship between a well's pH and its bicarbonate concentration is true?

A) A well with half as much bicarbonate as another well will have a pH twice that of the other well.

B) Wells that have more bicarbonate tend to have higher pH.

C) Wells that have more bicarbonate tend to have lower pH.

D) The bicarbonate concentration of the well water is unrelated to its pH.

7. A new well is discovered in West Texas with a bicarbonate concentration of 225 ppm. According to the line of best fit, which of the following best approximates the pH of the well water?

A) 7.1

B) 7.3

C) 7.4

D) 8.4

8.

$$25 = (ky - 1)^2$$

In the equation above, $y = -2$ is one solution. If k is a constant, what is a possible value of k ?

A) -13

B) -3

C) 0

D) 5

9. Andrew works out for 30 minutes every other day. If he spends 35% of his workout time one day waiting for the weight rack, how many seconds of that day's workout did he spend waiting for the weight rack?

A) 630

B) 35

C) 21

D) 10.5

10. If $8x - 8yz + 2 = 74$, what is the value of $x - yz$?

A) 2

B) 6

C) 9

D) 16

11. A chef trimmed fat off a steak and was left with a steak weighing 8.80 ounces. If the weight of the fat was equal to 12 percent of the original weight, what was the original weight, in ounces, of the steak?

A) 8.92

B) 9.20

C) 10.00

D) 11.20

12. A backpacker is packing survival rations that consist of granola bars and packets of peanut butter. A granola bar has 470 food calories, and a packet of peanut butter has 90 food calories. The backpacker makes the survival rations using a total of 10 granola bars and packets of peanut butter combined, and the granola bars and packets of peanut butter have a total of 1,660 food calories. Which of the following systems of equations can be used to determine the number of granola bars, g, and packets of peanut butter, p, that are in the survival rations?

A) $280(g + p) = 1{,}660$

$g - p = 10$

B) $90g + 470p = 1{,}660$

$g - p = 10$

C) $90g + 470p = 1{,}660$

$g = 10 - p$

D) $470g + 90p = 1{,}660$

$g = 10 - p$

13. Ten floorboards with equal widths laid down side-to-side cover a width of approximately $7\frac{3}{4}$ feet. At this rate, which of the following is the closest to the number of boards laid side-to-side needed to cover a width of 32 feet?

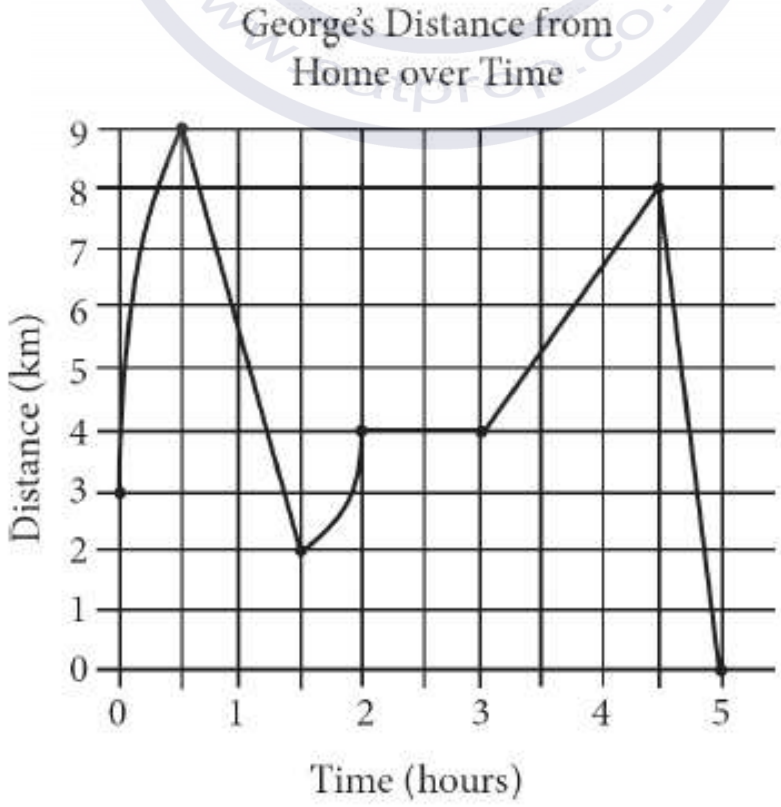
A) 15

B) 20

C) 30

D) 40

14.



George recorded his distance from home over a five-hour period; his distance and time are shown in the graph above. According to the graph, which of the following is NOT true about the five-hour period?

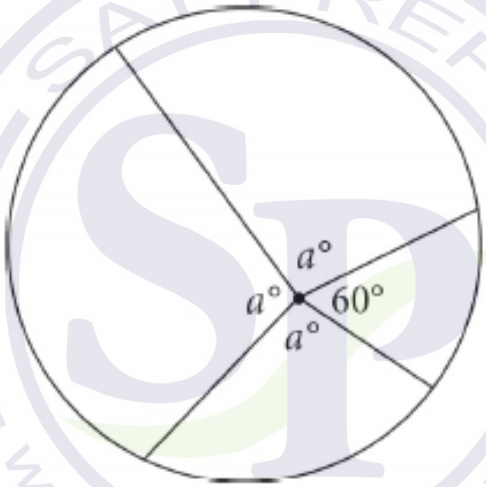
A) George's distance from home increased at a constant rate during the first hour of the five-hour period.

B) George's distance from home reached its maximum during the first hour.

C) George remained a constant distance from his home for one hour.

D) George was moving further from his home for a longer period of time than he was moving closer to his home.

15.



In the figure above, what is the value of a ?

A) 40

B) 60

C) 100

D) 130

16.

$$y = -75x + 5{,}000$$

The equation above models the amount of money y, in dollars, remaining in Bo's bank account x days after the start of the fall semester. The amount of money in Bo's bank account is based on the money he earned over the

summer and how much he spends per day during the fall semester. When the equation is graphed in the *xy*-plane, what does the slope of the graph represent in terms of the model?

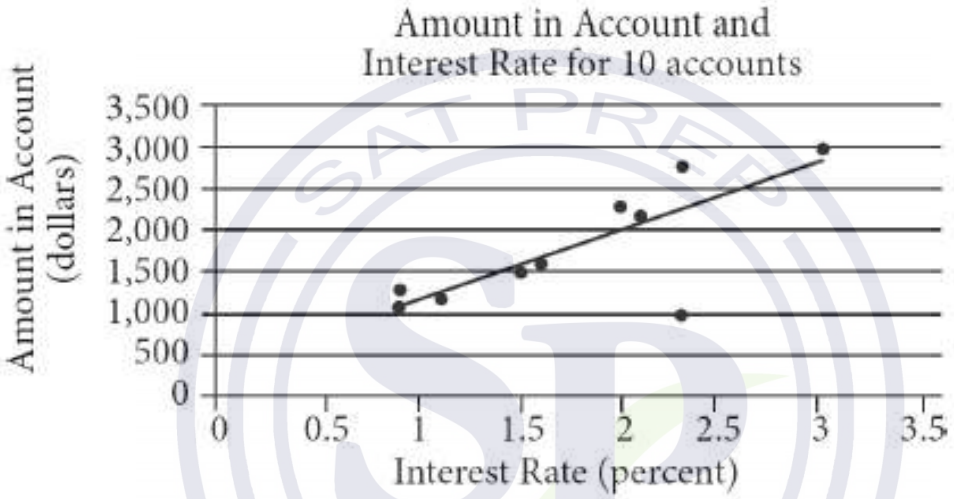
A) The total amount in Bo's bank account

B) Daily spending of $5,000

C) Daily spending of $75

D) The amount of money Bo earned over the summer

17.



The scatterplot above shows data for ten accounts opened by a company, along with the line of best fit. For the account that contains the least amount of money, which of the following is closest to the difference of the actual amount and the amount predicted by the line of best fit?

A) $200

B) $500

C) $900

D) $1,200

18. If $\frac{x}{3} = 4$ and $x + y = 32$, what is the value of $x - y$?

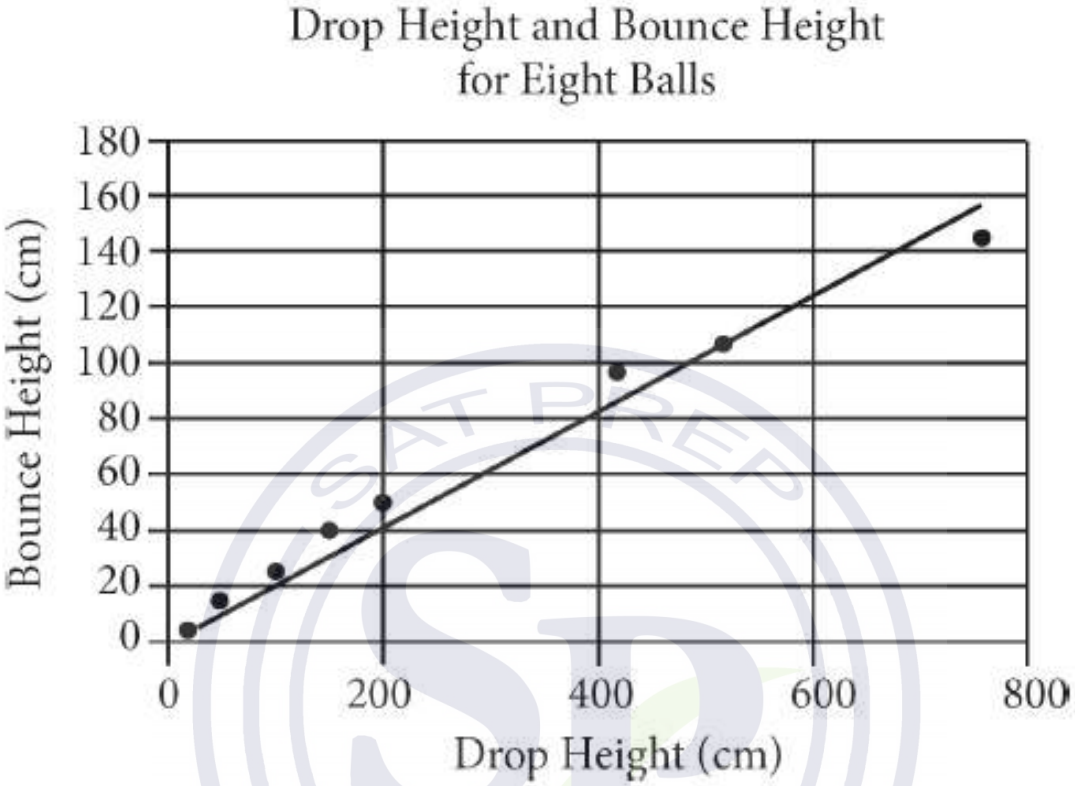
A) −24

B) −8

C) 12

D) 32

19.



The scatterplot above shows the height in centimeters for both the drop and bounce of eight different balls of the same type. The line of best fit for the data is also shown. According to the line of best fit, which of the following is closest to the predicted increase in bounce height, in centimeters, for every increase of 100 centimeters in drop height?

A) 25

B) 20

C) 15

D) 10

Questions 20 and 21 refer to the following information.

Formula A: $BMI = \frac{w}{h^2}$

Formula B: $BMI = \frac{4w - 100}{5}$

The formulas above are used in nutrition to estimate the body mass index *BMI*, in kilograms per square meter, of adults whose weight w ranges between 50 and 100 kilograms and whose height h is measured in meters.

20. Based on Formula B, what is w in terms of *BMI* ?

A) $w = 5BMI + 25$

B) $w = 5BMI - 25$

C) $w = \frac{5BMI + 100}{4}$

D) $w = \frac{5BMI - 100}{4}$

21. If both Formulas A and B give the same estimate for *BMI*, which of the following expressions is equivalent to $4w - 100$?

A) $\frac{w}{h^2}$

B) $\frac{5w}{h^2}$

C) $\frac{5w}{4h^2}$

D) $\frac{5w + 100}{4h^2}$

22. The number of bacteria colonies h hours after the beginning of an

experiment is given by the function $C(h) = 3h - 2h + 20$. What does the number 20 represent in the function?

A) The final rate of growth, in colonies per hour

B) The initial rate of growth, in colonies per hour

C) One less than the initial number of bacteria colonies

D) One more than the final number of bacteria colonies

23.

Agricultural Land as a Percent of Total Land Area, 2014

Country	Percent of Total Land Area
Brazil	33.8%
Canada	7.2%
Greenland	0.6%
Latvia	30.1%
Mexico	54.9%
New Zealand	42.2%
Russian Federation	13.3%
Turkey	50.1%
United States	44.6%

The World Bank measures the amount of land devoted to agriculture among all 196 countries in the world. The results from 9 of the countries are given in the table above. The median percent of agricultural land for all 196 countries is 34.95%. What is the difference between the median percent of agricultural land for these 9 countries and the median for all 196

countries?

A) 1.15%
B) 4.19%
C) 9.65%
D) 19.95%

24. To ship figurines, the figurines are placed in a rectangular box and then small packing pellets are added. The base of the box has an area of 4.4 in^2, and the height of the box is 6.5 in. If the volume of the air in the box after the figures and pellets are added is 8.0 in^3, which of the following is closest to the combined volume of the figurines and pellets in the box?

A) 1.9 in^3
B) 20.6 in^3
C) 28.6 in^3
D) 117.84 in^3

25. The economy of Argentina as measured by its Gross Domestic Product (GDP) is shrinking at a rate of 2.6% per year. In 2015, the GPD of Argentina was \$630 billion. Which of the following functions represents Argentina's GPD, A, in billions of dollars, y years since 2015 ?

A) $A(y) = 630 - (1 - 0.26)y$
B) $A(y) = 630(1 - 0.26)y$
C) $A(y) = 630 - (1 - 0.026)y$
D) $A(y) = 630(1 - 0.026)y$

Questions 26 and 27 refer to the following information.

Weights of Modern U.S. Coins

Coin	Grams	Drams
Penny	2.50	1.41

Nickel	5.00	2.82
Dime	2.25	1.27

The table above gives the average weight, expressed in both grams and drams, of three types of modern U.S. coins.

26. If y grams is equivalent to d drams, of the following, which best represents the relationship between y and d ?

A) $y = 1.8d$

B) $d = 1.8y$

C) $yd = 1.8$

D) $y = 0.56d$

27. If a bag of coins weighing 225 grams is filled with p pennies, n nickels, and d dimes, which of the following expresses d in terms of n and p ?

A) $100 - \frac{10}{9}(p + 2n)$ B) $100 + \frac{10}{9}(p + 2n)$ C) $100 - \frac{10}{9}(p - 2n)$

D) $100 + \frac{10}{9}(p - 2n)$

28.

$$(x - 2)^2 + (y + 5)^2 = 36$$

If a circle in the xy-plane has the equation above, which of the following does NOT lie on the exterior of the circle?

A) (2, 1)

B) (2, 5)

C) (5, 2)

D) (−1, 1)

29.

Month	Number of Peppers
June	2,200
July	2,640

A farmer counted the number of peppers produced by a certain field in June and July. The number counted for each month was recorded in the table above. The farmer estimates that the percent increase from June to July would be half the percent increase from July to August. How many peppers does the farmer expect the field to produce in August?

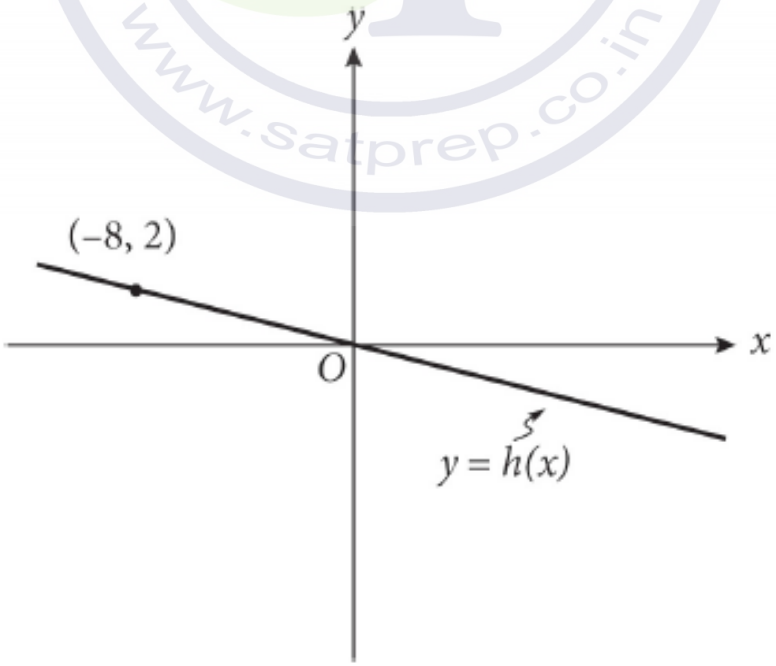
A) 2,860

B) 2,904

C) 3,520

D) 3,696

30.



In the *xy*-plane above, a point (not shown) with coordinates (a, b) lies on the graph of the linear function h. If a and b are nonzero integers, what is the ratio of b to a ?

A) −4 to 1

B) −2 to 1

C) −1 to 2

D) −1 to 4

DIRECTIONS

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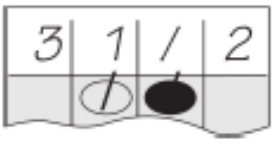
3. No question has a negative answer.

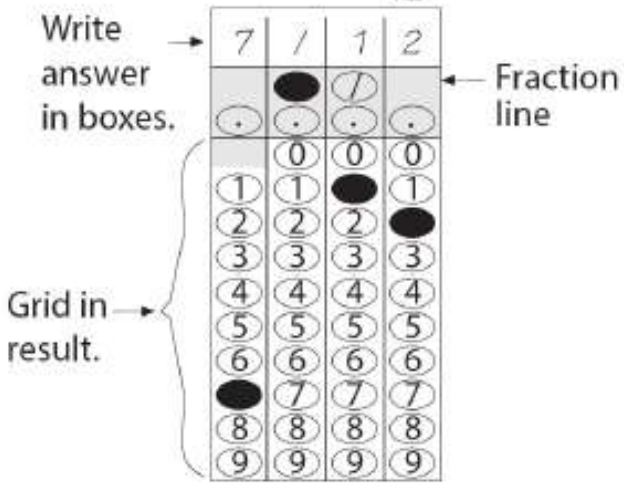
4. Some problems may have more than one correct answer. In such cases, grid only one answer.

5. **Mixed numbers** such as $3\frac{1}{2}$ must be gridded as 3.5 or 7/2. (If

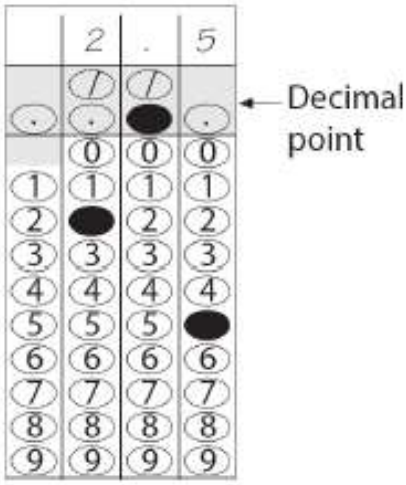


is entered into the grid, it will be interpreted as $\frac{31}{2}$, not as $3\frac{1}{2}$.) 6. **Decimal Answers:** If you obtain a decimal answer with more digits than the grid can accommodate, it may be either rounded or truncated, but it must fill the entire grid.

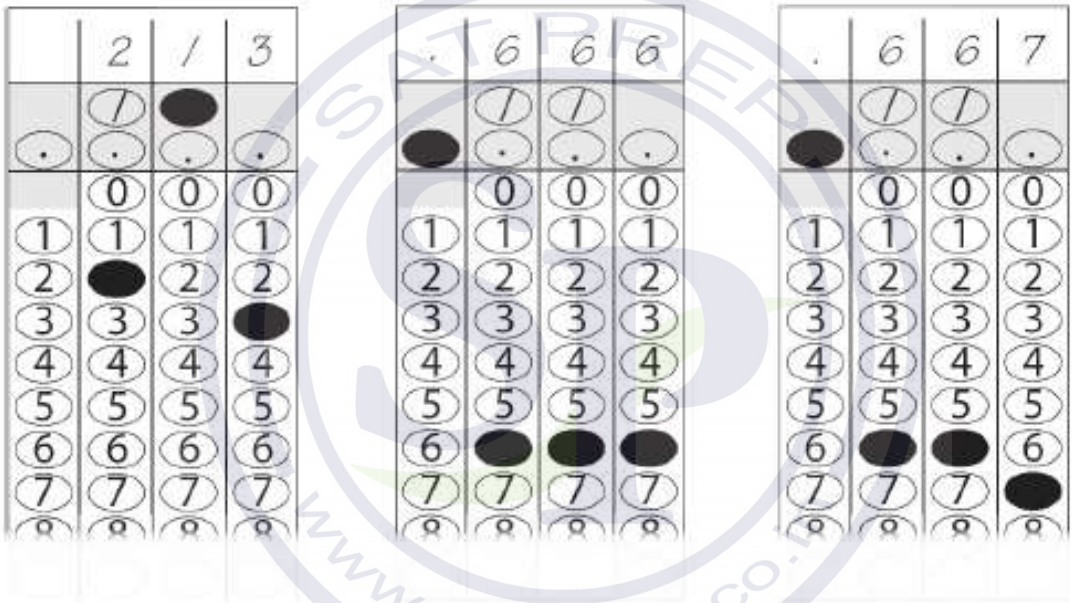
Answer: $\frac{7}{12}$



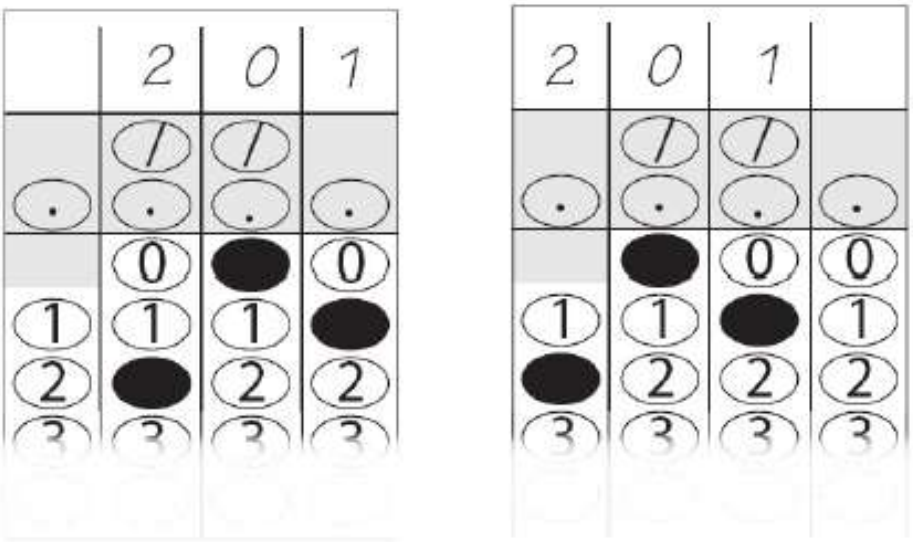
Answer: 2.5



Acceptable ways to grid $\frac{2}{3}$ are:



Answer: 201 – either position is correct

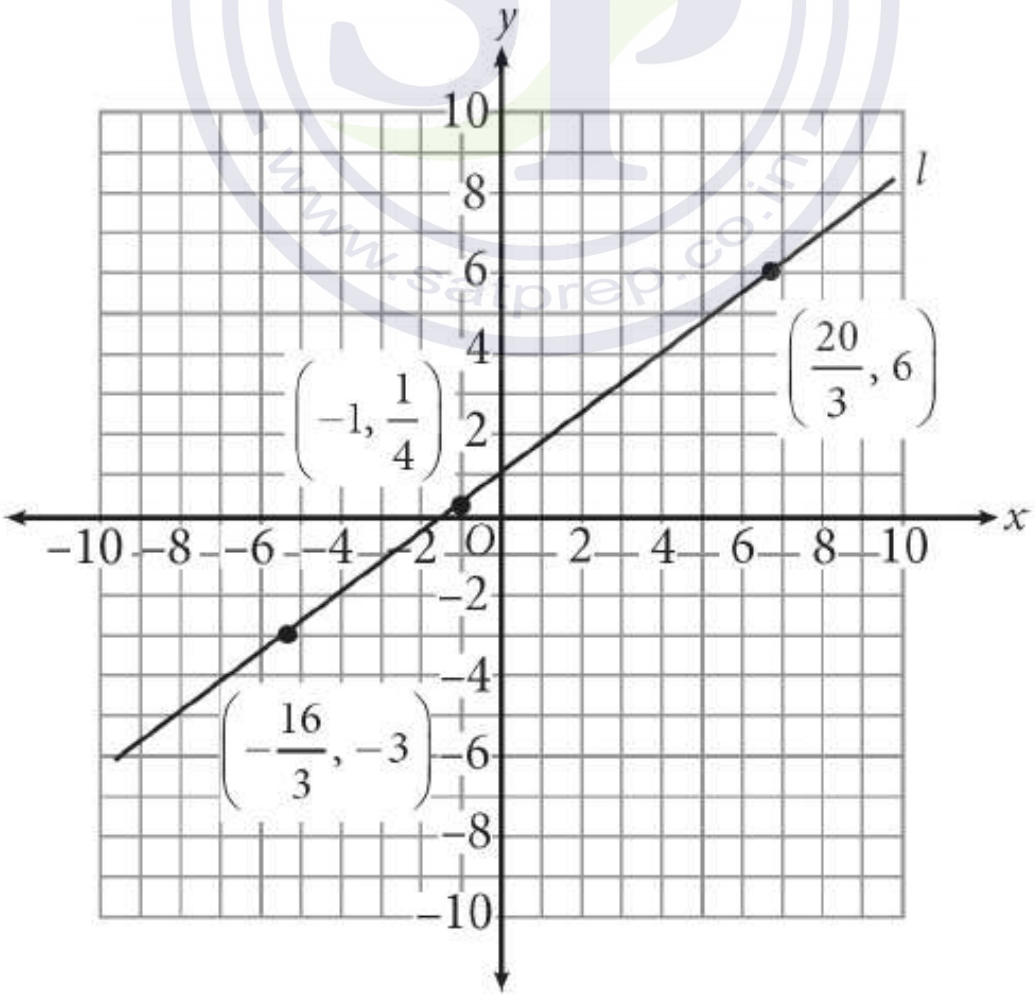


NOTE: You may start your answers in any column, space permitting. Columns you don't need to use should be left blank.

31. The raw score on a certain standardized test is determined by subtracting $\frac{1}{4}$ of the number of incorrect answers from the number of correct answers. If a student answered 30 questions and received a raw score of 20, how many questions did the student answer incorrectly?

32. One of the first diets to limit the intake of carbohydrates was prescribed by Dr. William Harvey in 1862. This diet consisted of three meals a day containing equal amounts of protein per meal. If protein contains 4 dietary calories per gram, and the diet consisted of 672 dietary calories of protein per meal, how much protein, to the nearest ounce, was in each meal? (1 ounce is approximately 28 grams.)

33.



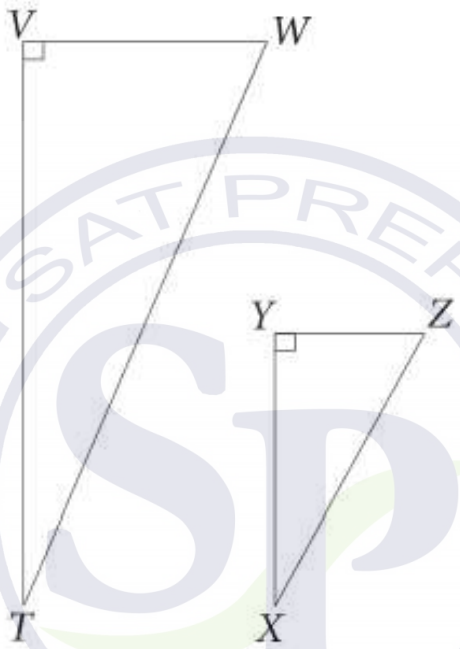
What is the slope of line l shown in the xy-plane above?

34.

$$-9 - a = b$$
$$a^2 - 6a - 9 = b$$

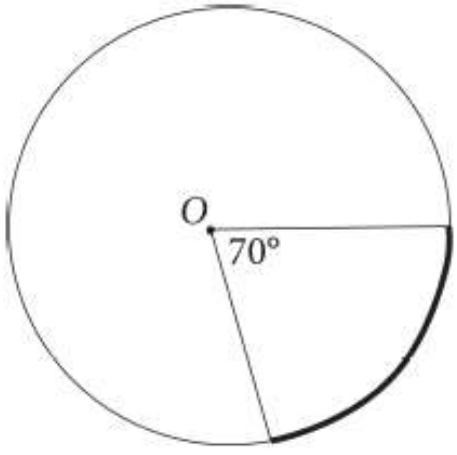
If the ordered pair (a, b) satisfies the system of equations above, what is one possible value of a ?

35.



In the figure above, $\sin T = \frac{5}{13}$. If $TV = 24$, $XZ = 13$, and $\angle W \cong Z$, what is $VW - YZ$?

36.



Point O is the center of the circle above. What fraction of the circumference of the circle is the length of the bolded arc?

Questions 37 and 38 refer to the following information.

Number of Participants by Number of Bullseyes Thrown and Day

Number of Participants by Number of Bullseyes Thrown and Day

	Day 1	Day 2	Day 3	Total
0 Bullseyes	2	3	4	9
1 Bullseyes	1	3	1	5
2 Bullseyes	2	3	7	12
3 Bullseyes	5	2	1	8
4 Bullseyes	3	2	0	5
5 Bullseyes	2	2	2	6
Total	15	15	15	45

The same 15 participants, on each of 3 days, threw 5 darts in order to win a bullseye contest. The number of players throwing a given number of bullseyes on each day is shown in the table above.

37. No participant threw the same number of bullseyes on two different days. If a participant is selected at random, what is the probability that the selected participant threw 3 bullseyes on Day 1 or Day 2, given that the contestant threw 3 bullseyes on one of the three days?

38. What is the mean number of bullseyes each participant threw on Day 2 ?